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Impacts of Water Resource Management Choices in Ceará, Brazil: Roles of Streamflow Forecasts, Rainfall Forecasts and Participatory Decision Making

Investigators Kenneth Broad
Alexander Pfaff
Upmanu Lall

Institutions University of Miami
Columbia University

We are currently in the process of preparing the survey information for the empirical analysis. The survey component of the project is underway. The process of entering the data from over 550 household surveys into spreadsheet form and reviewing the spreadsheets to validate the entries will be completed by the end of October.

During the period of data collection, we formulated two basic research ideas that we hope to pursue with the data at hand. Our first order of business is to fulfill the initial objective proposed in the NOAA grant: to integrate a behavioral component to a reservoir release optimization model to allow a more socially disaggregated consideration of an optimal water release regime in the semi-arid state of Ceará.

The survey data will be used to develop a parameterized farm household decision model, which allows for the measurement of the impact of increasing water availability on farmers' welfare. In our theoretical work, we focus on the multi-output primal technology. The empirical counterpart is to estimate a generalized linear transformation function. The results from the empirical model will show which inputs are complementary with water, the supply response of crops given changes in water availability, and how the marginal contribution of labor to the production of outputs changes with water availability. The impact of increasing water availability on welfare will be explicitly measured by calculating the producer surplus for each of the water availability scenarios in our survey, for each farmer type. We will also discuss how the equitable distribution of water may be enhanced or compromised by the use of climate-based forecasts to increase total water availability or to maximize aggregate productivity. Examining outcomes by type of water user allows exploration of the efficiency-equity tradeoffs.

Our second research pursuit involves observing the ability for households to cope or smooth consumption when facing water availability shocks. A large effort has been dedicated to determining how farmers cope with crop loss and weather shocks in the absence of insurance mechanisms and other institutions. Several papers suggest that farmers cope with these shocks by using savings, borrowing, risk sharing, or by liquidating their assets. Recent papers provide evidence that farmers cope with such shocks by adjusting labor supply. There is anecdotal evidence that farmers in Ceará migrate to urban areas or work on neighboring farms during times of limited water availability. If farmers are able to smooth consumption efficiently by adjusting their labor supply (and using other coping mechanisms), then the welfare impact of improving the infrastructure of water allocation may be greatly reduced.

In our survey, we collected extensive information regarding households' labor choices during different water availability scenarios. We will exploit this information to answer three questions regarding households ability to cope with water shocks: 1) What are the implications of water availability on total household hours worked? 2) Do we observe changes in who participates in the labor market under different water conditions? and 3) What job alternatives are people seeking under different water availability scenarios? The answers to these questions will suggest whether private coping mechanisms mitigate the losses experienced by farmers during periods of low water availability. We also will comment on the observed externalities associated with these coping mechanisms.